REMARKS/ARGUMENTS

In the application claims 2-13 are pending and subject to a final rejection. After due consideration of the Examiner's comments, Applicants have amended the claims as set forth above and request reconsideration of the amended claims. It is respectfully submitted that claims 2-15 as amended overcome all bases for rejection stated in the office action and, therefore, are allowable.

Oath/Declaration

The Examiner restates his comments regarding Dr. Piña's relationship to the claimed invention. Applicants reiterate that Dr. Piña has no relationship to the present invention; that his involvement was in the development of the Pixon® method for image reconstruction, which is distinct from the present invention. In support of Applicants' assertions regarding this issue, being submitted herewith is the declaration of Dr. Robert Piña confirming his non-involvement in the development of the method and system claimed in the present application (the "Algebron® method"). Dr. Piña's declaration also confirms the distinctions between the Pixon® method, which he co-invented, and the presently-claimed Algebron® method, with which he was not involved in any way. (See also ¶¶3, 4 & 8, Puetter Decl.)

Government License Rights

The Examiner repeats his objection regarding the absence of a statement of government license rights. Applicants again submit, with the support of the declaration of Dr. Piña, that the distinctions between the patented Pixon® method and the Algebron® method are such as to eliminate any relationship with the government grants under with the Pixon® method was developed. The present invention has nothing to do with image reconstruction and the invention was conceived and reduced to practice entirely at the expense of assignee, Pixon LLC, with no government funding whatsoever. Accordingly, the government has no interest or rights in the claimed invention. (See ¶¶6, 7, Puetter Decl.)

Claim Interpretations

In response to the Examiner's interpretation of "daily returns of financial securities" Applicants wish to clarify that "daily returns" are the fractional differences in the prices of

financial instruments relative to the previous business day, which is usually expressed in terms of a percentage. "Daily return" is a standard financial term that is well known in the art. (See, e.g., the enclosed articles: D. Laster and K. Cole, "Has the Stock Market Grown More Volatile?", *Current Issues in Economics and Finance*, Vol. 2:11, October 1996 (Federal Reserve Bank of New York); M.O. Fernandes and L. Torgo, "Predicting Daily Returns for the IBM Stock", Proceedings from the 2001 Workshop on Artificial Intelligence for Financial Time Series Analysis, Porto, Portugal (www.nlaad.liacc.up.pt/~ltorgo/AIFTSA/Proceedings/OT.pdf).

Claim Rejections under 35 USC §112

The Examiner rejects Claims 2-13 under §112, first paragraph, as containing subject matter not described in the specification. Specifically, the Examiner cites the terms "measured data" and "measured data points". The claims have been amended to replace these terms.

Double Patenting

The Examiner rejects Claims 2 and 8 under the judicially-created doctrine of obviousness-type double patenting over Claims 1 and 8, respectively, of Patent No. 6,353,688.

It is submitted that the cited claims are not drawn to the same invention and that the invention claimed in the present application, the Algebron® method, is patentably distinct from the Pixon® method disclosed and claimed in the '688 patent. Claim 1 of the '688 patent is drawn to a method for reconstructing an image from an image detector. Claim 8 of the '688 patent is drawn to a method of reconstructing a signal from a noisy input signal. Both claims cover the Pixon® method of reconstruction which uses components and attributes of the input data, e.g., the pixels of the image detector and the data contained within these pixels, to group the pixels in a way that represents the input data at the lowest possible level of complexity. Both claims include steps in which kernels are *dependent* upon the form and/or features of the input data. These kernels are functions of smooth variables such as time or position, so that location of the signal is of paramount importance. In Claim 1, the kernels are defined within a grid corresponding to the array of pixels from which the data are obtained. A map of contiguous and approximately homogeneous patches (kernels) is formed corresponding to the grid. The map is then used to reconstruct the image or signal. The map involves specification of a location within a grid along with how much of the grid at that location is covered by the corresponding kernel. Claim 8

reconstructs a signal where the input signal is divided (decomposed) into kernels, i.e., signal segments, of different sizes (scales). According to this method, the segments or kernels clearly correspond to locations within the signal. The location of each kernel within the overall input signal along with the amount of the input signal encompassed by each kernel must be determined in order to reconstruct the signal. In all cases, the claimed method relies on some reference, e.g., the image grid or the signal structure, to establish contiguity of the kernels in order to model the input image or signal.

In contrast, the presently-claimed Algebron® method assumes that the input data reside in multiple abstract variables that have no other attribute beyond their input data values. The variables that are used to model the financial return data are independent variables *that correspond to properties of the financial system,* not the input data. (See Claim 2, line 3; Claim 8, line 4.) There is no external grouping or classification to provide a reference "structure". The Pixon® method, which relies on contiguity, cannot model multiple, abstract algebraic variables which have no continuity. In other words, the variables used to describe the data are *independent* of the input data itself, unlike the kernels in the Pixon® method which are determined relative to and positioned (mapped) within the grid of the input image or signal. Financial instruments, for example, are not grouped by industry, product type or any other external reference. There is no step that involves locating the resulting subset of independent variables within an array or other specifiable grouping that corresponds to the input data structure. There is no structure upon which any contiguity information, or map, can be based, so the Pixon® method would be of no help in analyzing this type of data. Correlations are determined from the input data alone, not from any reference structure (real or virtual) as used in the Pixon® method. The use of *independent variables* in the Algebron® method represents a fundamental and highly significant difference between the two methods. The differences between the Pixon® method (as claimed in the '688 patent) and the Algebron® method of the present invention cannot be attributed solely to *intended use.* The differences between the types of data processed necessitates different methods. The two methods are structurally different and there is a *substantial manipulative difference* in how they handle their respective input data.

The Algebron® method could, in principle, be used to analyze image data by discarding the contiguity information, however, the results would be vastly inferior to those of the Pixon® method, which relies on contiguity information. The processing time needed to apply the

Algebron® method to imaging data would also be orders of magnitude longer than that taken by the Pixon® method, making the analysis impractical, in addition to being inferior.

For the foregoing reasons, it is submitted that there is no conflict between the present claims and those of the '688 patent and, thus, no grounds for a double patenting rejection.

Claim Rejections – 35 USC §103 - GARCH

The Examiner rejects claims 2-15 under 35 USC §103(a) as being unpatentable over GARCH in view of Office Notice.

Applicants respectfully submit that the GARCH Toolbox performs a completely different function than does the presently-claimed Algebron method and is applied to a different type of data. GARCH concerns itself with the variance of a single variable and how that variance evolves over time. The User's Guide for the GARCH Toolbox states:

> GARCH stands for Generalized Autoregressive Conditional Heteroscedasticity. Loosely speaking, you can think of heteroscedasticity as time-varying variance (i.e., volatility). [p. 1-2]
>
> The GARCH Toolbox, combined with MATLAB and the Optimization and Statistics Toolboxes, provides an integrated computing environment for modeling the volatility of univariate economic time series. [p. 1-4, emphasis added.]

Amendments to Claims 2 and 8 have added the limitation of the financial return data having "multiple covariances". This limitation was originally recited in Claims 3 and 9. Amended Claim 14 includes the added limitation of multi-variability of the covariance matrix. There is a significant difference between the modeling of a univariate time series in a system (GARCH Toolbox) and a system having multiple covariances as in the Algebron® method. The fact that there is a large number of interdependent variables makes the problem addressed by the Algebron® method far more complex than, and not an obvious variation of, the GARCH method. The GARCH Toolbox is structurally different as to input data and analysis goal and, consequently, also procedurally different.

The Examiner gives Official Notice that it would have been obvious to modify the teachings of GARCH to eliminate irrelevant parameters. Applicants do not dispute that elimination of irrelevant parameters would be obvious -- this is the well-known principle of minimum complexity. However, the combination of minimum complexity and GARCH does

not teach or suggest a method for finding minimum complexity in a complex system in which the data has multiple covariances, because GARCH deals only with estimating changes (volatility) in a single variable with time.

In contrast with Applicants' claimed method, GARCH does not perform factor analysis because factor analysis has no meaning when there is only a single variable. In fact, the term "factor" does not appear anywhere in the GARCH User's Guide. The following text, copied from The Statistics Homepage of StatSoft, Inc. (www.statsoft.com/textbook/glosfra.html), describes and illustrates factor analysis, the underlying principle of Applicants' method:

> The main applications of factor analytic techniques are: (1) to *reduce* the number of variables and (2) to *detect structure* in the relationships between variables, that is to *classify variables*. Therefore, factor analysis is applied as a data reduction or structure detection method (the term *factor analysis* was first introduced by Thurstone, 1931).

Factor analysis is a well known statistical method for attaining minimum complexity when there are multiple variables. As explained in the disclosure of the present application, factor analysis is a way of characterizing a large number N of interdependent (co-varying) statistical variables, X_α, by a smaller number k of independent statistical variables, f_β, which are called "factors". The present invention provides a novel variation on conventional factor analysis which involves minimizing the non-zero, off-diagonal factors of the loading matrices that make up the covariance matrix.

Because the GARCH Toolbox is directed to univariate analysis, the mere combination of the GARCH teachings with the principle of minimum complexity does not provide Applicants' invention. In fact, there would be no reason to apply minimum complexity to GARCH for determining the smallest subset of variables that fits the financial return data because GARCH begins and ends with only one variable. Applicants do not claim to have invented either minimum complexity or factor analysis. What is claimed in the present application is a combination of techniques which is used to find a minimally complex characterization of *multiple, abstract algebraic values* using factors which are independent of the input data except for the values for each data point. Accordingly, Applicants submit that the invention as claimed is not obvious over GARCH.

Claim Rejections – 35 USC §103 – Puetter Paper #2

The Examiner maintains the rejection of all claims under 35 USC §103(a) as being unpatentable over Puetter Paper #2 ("Pixon-Based Multiresolution Image Reconstruction and the Quantification of Picture Information Content").

For reasons stated in the preceding sections, Applicants submit that the Algebron® method is patentably distinct from the Pixon® method which is described in Puetter Paper #2.

With regard to the Examiner's comment that a "geometric structure" is created by plotting financial data, it is submitted that plotting multiple, abstract algebraic variables is merely a means of representing the data which does not introduce physical structure or continuity. If a plot or graph were to be used to classify or segment the data, it would introduce external information, which is contrary to the Algebron® method. The Algebron® method avoids imposing external groupings or values, using only the data comprising independent co-varying variables.

It is respectfully submitted that the Examiner has misunderstood the text that was quoted from Puetter Paper #2. This paper is exclusively devoted to images and the quantification of *picture* information content, as expressly stated in the title. The quoted sentence should be read to say that "Pixon-based image restoration/reconstruction has consequences and implications beyond the actual processing of the image, including the areas of image data compression and information theory of images." The sentence cannot be taken out of context of image (picture) information content because the entire paper discusses nothing but images.

Being filed herewith is the declaration of Richard C. Puetter, author of Puetter Paper #2 and co-inventor of the claimed invention. In paragraph 9 of his declaration, Dr. Puetter states that the subject matter of Puetter Paper #2 falls exclusively within the field of image processing and that the comment at page 1, column 2, para. 2 of the paper is intended to convey the idea that the Pixon method may also have applications in the areas of image data compression and information theory of images. Both data compression and information theory are commonly applied to image data. For example, see, e.g., J. Kim, et al., "Nonparametric Methods for Image Segmentation Using Information Theory and Curve Evolution", *2002 IEEE International Conference on Image Processing*, Rochester, NY, Sept. 2002, which is attached as Exhibit B to Dr. Puetter's declaration.

Furthermore, in his declaration, Dr. Puetter states that the Algebron method as claimed in the present application for analysis of abstract, algebraic variables had not even been conceived until 1996, nearly a year after the publication of Puetter Paper #2. Up until 1998, Dr. Puetter's work had focused on application and improvement of the Pixon method for image reconstruction, as is apparent from a review of his list of publications. A list of Dr. Puetter's publications is attached to his declaration as Exhibit A. Accordingly, he could not have suggested the application of the Pixon method to analysis of abstract algebraic variables in his 1995 publication or in any other publication which describes the Pixon method because he and Dr. Yahil had not conceived the idea until much later.

The Examiner states that references in the abstract of Puetter Paper #2 to the "pixons" being generalizations of both (1) Bayesian techniques of Algorithmic Information Content and (2) Akaike Information Criterion are very important, however, the importance of this fact is unclear since neither pixons nor these methods are claimed.

The mention of (1) Bayesian techniques of Algorithmic Information Content (AIC) and (2) Akaike Information Criterion in Puetter Paper #2 cannot simply be taken out of the context in which they were used. Both methods are well known in the field of statistical mechanics, as the Examiner acknowledges. Akaike's Information Criterion is a standard tool in time series model fitting, and its computation is available in many time series programs. It is not surprising that it is one of the tools in the GARCH Toolbox since the GARCH Toolbox is all about time series modeling. Applicants don't claim to have invented Bayesian techniques of Algorithmic Information Content (AIC) or Akaike Information Criterion. The fact that these well known methods were used in the statistically-based approach to image reconstruction described in the paper does not mean that all subsequent applications of these same statistical principles automatically flow from or obvious from this description. Puetter Paper #2 is about image reconstruction in which images have a structure that can be decomposed into smaller units, each having a location within the overall image. (See ¶10, Puetter Declaration.) Nothing in Puetter Paper #2 states or suggests that one can dispense with structure or location within the input data, using only multiple, covarying abstract variables to represent the data. There is certainly nothing in the GARCH Toolbox that suggests this since it teaches only univariate time series analysis.

It is submitted that the Examiner has simply sought terms that appear in both the GARCH Toolbox User Manual and Puetter Paper #2 to justify combining the references to support an

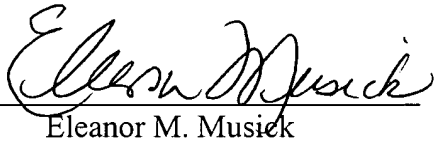
obviousness rejection without considering that these principles are not what is claimed. The mere application of statistical principles to solve different problems, in this case, image reconstruction and estimating volatility of financial returns, does not make all statistically-based solutions the same, or even obvious from one to the other any more than does the use of addition, subtraction or some other mathematical operation in two otherwise completely different processes.

In view of the foregoing amendments, comments and arguments, and the supporting declarations, Applicants respectfully submit that the method and system that is now claimed is patentably distinct over the prior art cited by the Examiner. Accordingly, it is requested that the Examiner withdraw the rejections and issue a notice of allowance with respect to all claims now presented.

Should the Examiner believe that prosecution of this application might be expedited by further discussion of the issues, he or she is invited to telephone the undersigned attorney for Applicants at the telephone number listed below.

Respectfully submitted,

Dated: August 25, 2003

By: 

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